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ABSTRACT

In providing for inservice nursing educational opportunities, the obvious advantages of the computer-assisted instruction (CAI) mobile system are its inherent interactive quality and the flexibility of scheduling made available to those who are already working in a field. The rationale for the development of the system is based on the past and continuing success at Pennsylvania State in retraining inservice teachers via mobile CAI. Preliminary followup evaluation results have shown that teachers find the content useful and the delivery system very adaptable to their needs and would be willing to take additional courses by CAI. It is estimated that a single mobile van can facilitate 1,5000 three-credit course completions annually at a cost of approximately $60 per course or $20 per credit hour for a fully amortized computer and mobile laboratory. (Author/JY)

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THE DEVELOPMENT AND UTILIZATION OF MOBILE CAI FOR THE EDUCATION OF NURSES IN REMOTE AREAS

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Abstract

This paper describes an application of computer technology for the continuing education of nurses. The obvious advantages of the CAI mobile system are its inherent interactive quality and the flexibility of scheduling made available to practicing nurses. The rationale for the initiation of this effort is based on a past and continuing success in retraining inservice teachers via mobile CAI. Preliminary follow-up evaluation results have shown that teachers find the content useful and the delivery system very adaptable to their needs and would be willing to take additional courses by CAI. It is estimated that a single mobile van can facilitate 1,500 three-credit course completions annually at a cost of approximately $60 per course or $20 per credit hour for a fully amortized computer and mobile laboratory.

In November 1970, the staff of The Pennsylvania State University inaugurated a new and sophisticated computer mediated instruction technology into its inservice continuing education programs. We believe it represents the first application of a major new technology in continuing education since the advent of broadcast television in the late 1940's. Computer mediated techniques continue to be used to present complete college-level courses to inservice teachers in addition to the newly developed course offerings for registered nurses.

Hardware Design

The computer manufacturer and the van manufacturer worked carefully with us during the early stages of design to insure that we had

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a highly efficient mobile laboratory that would meet the environmental requirements of the computer equipment. The experience of the van manufacturer in designing and constructing military mobile units was very helpful to our effort. Efficient use of space was of prime importance so that we could provide 16 student stations, cable troughs for those stations, service clearance for all components, access space for loading instructional materials, and accommodate 18 individuals (16 students and two staff members) comfortably at any one time and yet transport the unit conveniently on any highway in the Nation without damage to the equipment. Environmental controls were required to provide the proper operating temperature for both the machines and the learners at a noise level that was acceptable. Monitoring devices were included to report to the van manager the electrical voltage being provided to the laboratory and the status of the air conditioning and heating system without hiring a maintenance engineer.

One mobile system has been in operation since November 1970, a second one was added to the operation in the summer of 1974, and a mobile nursing education laboratory has been in operation since October 1975. We are just now collecting preliminary performance data on the nursing programs from McKeesport, Pennsylvania, where the nursing van is presently located. The evaluation of the mobile CAI concept and implementation for nursing at this point in time can best be projected from the experience of mobile CAI for inservice teachers.

Summary of Mobile Inservice Teacher Education Program

Under the leadership of Professors G. Philip Cartwright, Carol A. Cartwright, and Marjorie E. Ward, a series of self-contained college-level CAI courses called CARE: Computer Assisted Renewal Education help regular classroom teachers develop clinical sensitivity and diagnostic awareness of the strengths and weaknesses of handicapped and normal children. CARE 1, Early Identification of Handicapped Children, is designed to prepare inservice, preschool, and primary teachers to know the characteristics of and be able to identify handicapped children. CARE 1 has been in regular use since 1970. The primary objective of CARE 2, Diagnostic Teaching of Preschool Children, is to teach regular and preschool teachers, teachers aides, child care workers, and child development workers to work effectively with children who have learning disabilities, mental retardation, cultural disadvantage, and emotional disturbance and has been in regular use since 1974. CARE 3, Diagnostic Teaching of Primary Children, is essentially the same as CARE 2 except that the focus is on teaching primary children. CARE 3 has also been available since 1974. CARE 4, Education of Visually Handicapped Children, is a course designed to equip regular classroom teachers with the knowledge and skills necessary to manage within regular classrooms the instruction of children who have partial vision and those who are blind. CARE 4 has been in regular use since 1973.

The plan by which working teachers and other educators take advantage of the program is as follows:

On a pre-arranged schedule, the van is pulled to a school in a rural community and connected to electric, telephone, and water services.

Over the next eight weeks, in late afternoon and evening hours, elementary teachers and their supervisors are scheduled for one to three hour sessions at computer terminals on an individualized basis. These teacher-students can arrange flexible and irregular schedules at the computer terminals to fit into the demands of their personal lives.

The students interact at the terminals with a teaching program which has been prepared and tested by the members of the faculty of the University, in cooperation with the staff of the Computer Assisted Instruction Laboratory.

In addition to the program of instruction stored in the computer, each student may be required to use a textbook, a handbook, a set of materials for testing young children, and other appropriate teaching tools.

When the teacher-student completes a course, he takes a final examination generated by the computer from a pool of test questions covering the objectives of the course. A complete record of each participant's performance, not only on the test, but on the marking, and course improvement by the authors.

Teacher-students are awarded marks by University faculty members and they receive graduate level college credits, appropriate to the amount of curriculum included in the program.

In addition to the CARE programs being offered regularly through the mobile CAI laboratories they are offered in the resident instruction program at the University Park Campus of Penn State. Table 1 summarizes the utilization of these programs since 1970. In summary, over 9,500 students have received more than 27,000 credit hours from the CAI CARE curriculum. The fixed site system on the University Park Campus plus the two mobile CAI laboratories

have produced more than 270,000 hours of tutorial instruction for preservice and inservice teachers.

Table 1

CARE Utilization Summary
1970 - 76*

	Mobile Vans	University Park	Total
Students Served	4,641	4,874	9,515
Student Credit Hours Produced	13,335	13,932	27,267
Hours of Tutorial Instruction Provided	133,350	139,320	272,670

*March 1, 1976

Cost of Program

Now to answer the pragmatic question, "What does this program cost?" First, some operating characteristics and parameters need to be mentioned. It takes the equivalent of approximately 2 full-time staff members to operate the system in the field, exclusive of computer maintenance, moving the vehicle, and curriculum support activities. Fifteen student stations operated about 90 clock hours per week including evenings and weekends gives us the maximum of 1,350 terminal

hours per week. In an 8-week setting the maximum output would be 10,800 hours. Assuming that the utilization factor is 70 per cent we can count on generating about 7,560 terminal hours in 8 weeks. Now if the average number of clock hours required by a student to complete a typical program is 30, then we can expect about 250 course completions in an 8-week period. Naturally, if the utilization rate goes down for any reason, the number of course completions will suffer. We estimate that we can complete 6 full 8-week settings in a 12-month year, and leave time for set-ups, tear downs, and short moves. By completing 6 settings per year our annual mobile van through-put with a 15-station van is about 1,500 course completions as is shown in Table 2.

Table 2

Instructional Capacity of a Mobile CAI Laboratory

Number of Terminals (Student Stations)	15
Number of Hours Per Week in Service	90
Number of Terminal Hours Generated in an 8-Week Setting (70% Utilization)	7,560
Average Clock Hours Per Course Completion	30
Number of Course Completions in an 8-Week Setting	250
Annual Number of 8-Week Settings	6
Annual Course Completions	1,500

Second, let us look at the estimated annual operational costs for a mobile van with a paid-up computer on board. The assumption is made that the vehicle and computer are owned by the operating agency and have been completely amortized by outright purchase.

Table 3

Annual Operating Expense

Personnel	$26,000
Computer and Van Maintenance	30,000
Relocation and Electrical Hook-ups	9,000
Instructional Materials	5,000
Curriculum Services	20,000
ANNUAL TOTAL	$90,000

Annual operating costs of approximately $90,000 producing 1,500 3-credit course completions each year makes the cost of a 3-credit course $60 and the cost per credit hour $20 (Table 4). The latter figure is approximately 45% of Penn State's current in-state tuition rate.

Table 4

Cost Per Instructional Unit

Annual Operating Cost	$90,000
Annual Course Completion	1,500
Cost per 3-credit course	$60
or	
Cost per credit hour	$20

When most people look at the program and see the equipment in a tight configuration, they ask if it isn't awfully expensive. I admit that it is, but looked at from the standpoint of productivity, it isn't as costly as it looks.

Evaluation

Educators who have taken the courses report a high degree of satisfaction with the curriculum and with the method of instruction. Measured average increases in subject matter achievement on the part of participants have been substantial. For example, in one study students who took the CARE 1 course using the computer averaged scores on the final exam which were 24% higher than the scores of students who took the same course in the traditional classroom. Also CAI students have realized a considerable savings in time when compared with

students instructed in the conventional manner. In the same study, the CAI students completed the course material in one-third less time than that taken by their peers in lecture/discussion classes.

Further evaluative information was obtained from a study of the opinions of 31 regular classroom teachers in Pennsylvania. These teachers took the CARE 1 course during September and October of 1971. A follow-up study was made in July of 1972. Some typical results are shown in the following:

> Would you say that after taking the course you were more aware of individual differences in children?
>
> (Yes - 94% No - 6%)
>
> As a result of taking the course, do you feel better able to identify behaviors which may be signs of potential learning problems?
>
> (Yes - 100% No - 0%)
>
> Would you take another course by CAI?
>
> (Yes - 100% No - 0%)
>
> Did you find that CAI was a more convenient way of taking the course than attending classes at a local college or university?
>
> (Yes - 100% No - 0%)

These results can be summarized briefly as follows: First, in-service teachers do find the content of CARE 1 to be useful in dealing with the needs of children. Second, they like instruction by computer in that 100 per cent say they would take another course by CAI and third, they feel that CAI is more convenient than attending classes in a college or university.

The benefits of mobile CAI, whether for teachers or for nurses can be summarized as follows:

1. Flexibly scheduled instruction outside regular hours of work and schooling.
2. Instruction outside rigidly timetabled periods of instruction.
3. Instruction when and where qualified personnel are not readily available.
4. Adaptation of instruction which can include variations in:
   a. speed with which courses are completed.
   b. instructional method - tutorial, drill, or simulation.
   c. depth of interest on the part of the learner.
   d. remedial choices and enrichment excursions.
   e. diagnoses of individual errors and assignment of remediation.
   f. immediate feedback.
   g. modification of instructional strategies to match learner competencies.
5. Increased opportunities for independent study.
6. Richer variety of courses and methods of instruction.
7. Increased quality control of course of instruction with increased confidence in results obtained.